CONSERVATION OF CULTURAL AND SCIENTIFIC OBJECTS

In creating the National Park Service in 1916, Congress directed it "to conserve the scenery and the natural and historic objects and the wild life" in the parks.[1] The Service therefore had to address immediately the preservation of objects placed under its care. This chapter traces how it responded to this charge during its first 66 years. Those years encompassed two developmental phases of conservation practice, one largely empirical and the other increasingly scientific. Because these tended to parallel in constraints and opportunities what other agencies found possible in object preservation, a preliminary review of the conservation field may clarify Service accomplishments.

Material objects have inescapably finite existence. All of them deteriorate by the action of pervasive external and internal agents of destruction. Those we wish to keep intact for future generations therefore require special care. They must receive timely and. proper protective, preventive, and often restorative attention. Such chosen objects tend to become museum specimens to ensure them enhanced protection.

Curators, who have traditionally studied and cared for museum collections, have provided the front line for their defense. In 1916 they had three principal sources of information and assistance on ways to preserve objects. From observation, instruction manuals, and formularies, they could borrow the practices that artists and craftsmen had developed through generations of trial and error. They might adopt industrial solutions, which often rested on applied research that sought only a reasonable durability. And they could turn to private restorers who specialized in remedying common ills of damaged antiques or works of art. Although these skilled craftsmen and artists could often mend and refinish with cosmetic success, what they did to improve the appearance or utility of an object frequently impaired its historical integrity and future conservation.[2]

A profound change in the approach to object conservation took root in a few centers before World War II. In 1929 the Fogg Art Museum at Harvard set up what soon became the Department of Conservation and Technical Research. Edward W. Forbes, the museum director, staffed the department with a chemist and an x-ray specialist as well as an art historian. In 1932 it began publishing a scholarly journal, *Technical Studies in the Field of the Fine Arts,* which continued through ten volumes before the war terminated publication. This reported scientific studies of artists' materials and techniques, the causes and products of deterioration in paintings and other works of art, and new materials and methods to prevent or correct damage to these objects. The department's students found

employment as art museum directors, curators, and a new breed of specialists who came to be called conservators. The latter, few in number, were the first scientifically trained practitioners of object conservation in America.

By the end of World War II numerous art museums must have known of the Fogg's pioneering work but few had been able or willing to embrace it. Museums of art, science, and history tended to operate in separate spheres with little intercommunication. Many art museums continued to place their trust in restorers who clung to traditional empirical treatments. Some art experts relying on aesthetic judgment questioned or bitterly opposed the scientific findings. The high costs of equipping and staffing adequate conservation laboratories deterred many museums. The consequent lack of demand for trained conservators tended to dry up the meager sources for training.

Scientific conservation continued to grow nevertheless. In 1950 members of the original Fogg program joined with staffs of similar laboratories and individuals imbued with the same concerns to organize the International Institute for Conservation of Historic and Artistic Works (IIC) headquartered in London. Subsidiary national groups formed under its wing in many countries. IIC proved an effective means to stimulate continued research and training. It set standards for the new profession and multiplied the amount and availability of technical information. The American group initiated a code of ethics in the early 1960s that emphasized the profession's basic tenet: "unswerving respect for the aesthetic, historic and physical integrity of the object."[3]

Training for conservation came to mean several years of rigorous graduate study and internship or the equivalent in apprenticeship under a master conservator. Formal training of this scope became available again in the United States beginning in 1960.[4] The principal centers focused on fine arts conservation, although museums also needed scientifically trained conservators of more mundane cultural objects and even natural history specimens. If one wished to become a qualified conservator of such material the pathway remained less clear until the 1980s, when training programs for work on library materials, anthropological specimens, architecture, and other specialties began to take shape.

Conservators needed to perform three well-defined functions: examining objects to confirm and record their significance, original composition, and condition; preserving objects by environmental control or treatment to prevent or decelerate continued deterioration; and restoring objects when necessary to make them understandable with minimum loss of integrity.[5] In so doing they had to work in close collaboration with two other kinds of experts. Curators possessing thorough knowledge of the nature, significance, and context of objects needed to define the specific goals for their

conservation. Conservation scientists had to analyze and test materials, environmental influences, and procedures to establish the appropriateness and adequacy of treatment. As conservation scientists continued to refine the materials and methods for treatment, trained conservators inevitably applied ones that were later superseded by others better protecting the integrity of the objects.

The Empirical Phase, 1916-1948

As was true in museums outside the parks, object conservation in the parks during this period tended to apply practical methods based on everyday experience and observation rather than scientific analysis. The Park Service director's first annual report to the secretary of the interior in 1917 noted two urgent conservation situations that illustrate the point.

One involved a collection of deteriorating totem poles at Sitka National Monument. These striking objects, significant as documents of native culture, were the primary visible resource attracting visitors to the park. The Service obtained $1,000 in its 1918 appropriation to appoint a Sitka resident as monument custodian and have him treat the poles. Over several years decayed wood was chiseled out and replaced with new cedar, and new paint was applied. "It is anticipated that when these repairs are completed the poles will be preserved permanently, or at least that heavy repairs will be rendered unnecessary for many years," the director's 1926 report declared. The old poles nevertheless deteriorated beyond repair by 1940, when CCC workers carved reproductions incorporating bits of the old ones.[6]

A Canadian crew, faced with the same basic problem during the 1920s, analyzed the need more scientifically. They developed a procedure for reinforcing original totem poles, using tested wood preservatives, isolating untreated old wood from contact with the soil, sealing it, and finally painting it in close consultation with knowledgeable natives to match original colors. Poles decayed beyond repair were carefully taken down and protected from further weathering. In 1931 the National Museum of Canada published a description of the process that the Park Service reprinted ten years later in its *Field Manual for Museums.*

Response to the second conservation need cited in the director's 1917 report was also empirical but reflected more interest in scientific guidance. At El Morro National Monument both vandalism and weathering threatened the inscriptions carved in a sandstone outcrop by passing travelers of preceding centuries. As common-sense preventive conservation, the Service installed fencing and protective plantings to deter modern visitors from adding to the incised record. These and other measures did not protect the inscriptions from the weather, and in 1920 the Service sent a block of the

sandstone to the National Bureau of Standards for experimental treatment. Scientists there tried to impregnate the stone with some binding agent, but the binders penetrated only a short distance. Because the artificially consolidated outer layer expanded and contracted with temperature changes at rates different from the underlying rock, it tended to spall off in chunks.

Concern with object conservation necessarily increased with the rapid growth of the national park system and its museum program in the 1930s. Early in 1935 the Field Division of Education at Berkeley issued Museum Preparation Memorandum No. 1, which pointed out the importance of counteracting rapid deterioration in specimens and getting them stabilized. It offered no hands-on assistance from the division but recommended two recent, inexpensive publications containing sound, scientific guidance in object conservation. *The Preservation of Antiquities* by Harold J. Plenderleith of the British Museum Laboratory provided clear descriptions of materials commonly found in the composition of ancient artifacts, the nature of their deterioration, and practical methods of cleaning and preservative treatment the laboratory had developed and tested. The 1929 annual report of the National Museum of Canada contained a paper by Douglas Leechman giving comparable information for anthropological museum specimens of North American origin.[7] Carl Russell probably had copies of both sent to all parks, which could not have found better instructions at the time.

This infusion of scientifically based technical information contributed directly to specimen treatment in some parks. When Jean (Pinky) Harrington took charge of the nascent historical archeology projects at Colonial National Historical Park in 1936, he set up a laboratory to clean and treat the vast number of artifacts being recovered (Chapter One). Perhaps the most sophisticated procedure employed there involved the iron objects. Supervised CCC enrollees hand-cleaned these heavily rusted specimens, wrapped them in strips cut from sheet zinc or covered them with the more expensive granulated zinc, and immersed them in dilute sodium hydroxide for hours or possibly days. An electrochemical reaction generated hydrogen, reducing the rust to iron. The specimens then required thorough washing, perhaps brushing, and oven drying before being coated with melted paraffin. A published account of the Jamestown laboratory's procedures cited the Plenderleith and Leechman instructions as the principal sources.[8]

Another example of their influence occurred nearby. In 1937 Paul Hudson, the park curator at George Washington Birthplace National Monument, prepared excavated brass artifacts for exhibition by cleaning them with 10% acetic acid to remove surface corrosion and coating them with celluloid dissolved in acetone. These methods came directly from Leechman's paper. Because Hudson and other park staff who applied the

newly available information were untrained in scientific conservation, their use of the techniques remained empirical.

The same scientific publications also influenced thinking at higher levels in the organization. In a December 1936 report Ned Burns restated Service responsibility to preserve objects of scientific or historic value related to the parks. "These specimens require professional attention for their repair, cleaning and preservation in accordance with the most modern methods . . . ," he wrote. "Unless constant protection is provided by skillful and experienced technicians serious loss and irreparable damage will result through their deterioration." Such technicians scarcely existed at that stage, however, forcing Burns to rely on exhibit preparators in the museum laboratory whose manual skills he trusted. In 1937 he had an exhibit artist from the laboratory restore murals at Arlington House probably originally executed by George Washington Parke Custis. The paintings restorer then working at Morristown National Historical Park was doubtless equally ignorant of the new standards for such work developed at the Fogg Museum. In 1938 Burns detailed one of his preparators to instruct and supervise CCC enrollees at Cacapon State Park, West Virginia, in cleaning and restoring 175 antique specimens of various kinds.[9]

Scientific procedures, on the other hand, characterized Burns' response to another conservation challenge. In June 1935 two Mammoth Cave National Park guides discovered the mummified body of a pre-Columbian Indian some two miles within the cave. The park exhibited the body near the discovery site in an available showcase. In about two months mold was apparent on the mummy's skin. Burns reasoned that the immediate cause involved the old showcase. Turning on its lights warmed the enclosed air, accelerating mold growth. The air cooled and contracted when the lights were off, sucking in more damp cave air, which also favored mold. But why had the body not decayed in the cave's moist atmosphere? The cave's history had demonstrated the presence of saltpeter in the sediments that had washed into the underground passages. Chemical analysis revealed the nitrate in the sand on which the mummy had lain and in body tissues as well. Burns theorized how the infusion might have occurred and devised a corrective treatment.

First he cleaned away the surface mold using a soft brush, selected solvents, and the assistance of one of his exhibit preparators. Then he had the mummy placed in a tight wooden box. Within the box it rested on a wire mesh shelf above ten pounds of dehydrated calcium chloride. By blowing warm, dry air through the box he dried out the body enough to inhibit continued growth of the mold without attendant damage. Then he impregnated it with a fungicide, thymol dissolved in alcohol. Meanwhile he ordered a new table case manufactured to exact specifications. Its unique feature was a shallow drawer beneath the case floor to hold calcium

chloride for dehumidifying the air in the case and thymol to kill any mold that recurred. The drawer automatically opened or closed a tight-fitting trap door in the floor of the case as it slid in or out. Burns carefully positioned the mummy in the case, charged the drawer with its chemicals, and instructed the park staff to keep them replenished.[10]

When Mammoth Cave National Park a few years later became concerned about the condition of the historic saltpeter vats in the cave, it turned again to the Museum Division for advice. Burns arranged to have selected samples of the old wood analyzed by the Agriculture Department's Bureau of Chemistry and Soils as the first step in planning proper treatment.[11] A second Museums Association booklet by Harold Plenderleith, *The Conservation of Prints, Drawings, and Manuscripts,* had alerted him to scientific developments in paper conservation. To inform those park museums having manuscripts on display he quoted at length from this publication in the Museum Division's monthly report for January 1940. The March 1940 report showed him also well aware of progress being made in document care by the National Archives. From this report parks learned that the Archives would, upon specific request from the director, laminate in cellulose acetate significant historic documents from park collections. Lamination represented a line of conservation research largely distinct from what came out of the scientific laboratories of the Fogg and a few other art museums. As host to the Park Service engineering laboratory for a few years just before World War II, the Museum Division also kept in touch with its research on conservation of building materials.

Empirical treatment of museum objects nevertheless remained the norm. The Service in 1940 received for the Lincoln Museum the objects used as evidence at the 1865 trial of the assassination conspirators, including Booth's murder weapon, his telltale diary, the leather boot Dr. Samuel Mudd had cut from his broken leg, and the various guns and knives carried by his accomplices. Exhibit preparators in the Museum Division laboratory cleaned the items, which had lain secure in a Treasury Department vault since the trial, and applied any preservative treatment that seemed necessary to ready them for exhibition. Six months later Salem Maritime National Historic Site sent to the Museum Division a parchment stencil and other items that Nathaniel Hawthorne had used as an official in the Salem Custom House. Again the preparators cleaned and repaired the specimens for display.[12]

Often curators applied preservative techniques, likewise empirically rather than scientifically. Late one afternoon in 1941 Ralph Lewis checked on some matter in the Lincoln Museum vault and found the uniform of Major Henry R. Rathbone, a guest of the Lincolns at Ford's Theatre, heavily infested with clothes moths. Seeing the infestation as a conservation emergency, he promptly carried the uniform upstairs to the empty

laboratory, soaked it thoroughly with carbon tetrachloride, and hung it to dry overnight. His choice of treatment typified empirical conservation. The chemical was at hand, not yet outlawed because of its toxicity. Lewis knew it was used for insecticidal fumigation in combination with another chemical. Dry cleaners also used it, so it should not damage the textile. In this instance the treatment eliminated the infestation without apparent side effects in spite of inadequate analysis.[13]

Clearly understanding the need curators and preparators untrained in conservation had for better empirical guidance, Ned Burns devoted more than a quarter of the *Field Manual for Museums* to a Technical Methods chapter. The introductory paragraph on cleaning and preservation stated the importance of approaching these tasks scientifically: "It is essential to know, first, the physical and chemical properties of the objects to be cleaned . . . . The chemical nature of the material to be preserved as well. as the composition of foreign substances to be removed should be determined by tests to avoid mistakes in treatment."[14] The chapter said little more about how to make or obtain such analyses, for which few museums in or out of the parks had proper means. What it did supply were brief, clear instructions and precautions curators or preparators should follow in treating the principal kinds of specimens. It concluded with a useful glossary of the materials museums used in preparing and preserving objects. About as soon as the *Field Manual* made these empirical data readily available, Burns started drafting a handbook for the Committee on the Conservation of Cultural Resources as it prepared American museums to protect their collections under wartime emergencies (Chapter Three).

The Service museum program had not yet really crossed the threshold from empirical to scientific conservation, as revealed by its efforts to cope with the Gettysburg cyclorama. This huge painting depicting the battle of Gettysburg had been on view in Gettysburg for many years before the Service acquired it in 1942. The simple building that housed it lacked the means for proper climate control and was penetrated by driving rains. The artist's canvas, heavy with paint and hanging from its upper edge, had weakened with age. Grime dimmed the painted surface. Burns inspected the acquisition and advised the park to do what stabilizing it could with its own employees, but he suggested no specific measures.

After the war the Service's 1948 appropriation included $10,000 for conservation of the cyclorama, and Burns took prompt action. The critical changes in painting conservation techniques emanating from the Fogg Museum had evidently not captured his attention. Instead he worked out contract specifications with Carlo Ciampaglia, a New York muralist. Ciampaglia and a few assistants washed the painted surface of the cyclorama with soap and water and glued a horizontal strip of new canvas to the back as an attachment for added support.[15] This treatment involved

risks to the painting that scientific conservators would have avoided. About this time Yosemite National Park engaged a San Francisco restorer to work on some of its fine paintings. Also of the old school, he practiced reforming varnish coatings and other methods outdated by the research at Harvard and elsewhere.

The Scientific Conservation Phase, 1949-1982

Within the Park Service archeologists working in the Southwest, perhaps Charlie R. Steen in particular, first realized the importance of conservation based on scientific principles. Concerned about the continued deterioration of wall paintings and plaster in the old mission church at Tumacacori National Monument, Steen contacted the Fogg Museum for advice. R. John Gettens, the museum's chief of technical research, visited Tumacacori in June 1949 to study the materials and conditions involved. Back at his laboratory Gettens formulated a synthetic resin designed especially to spray-coat the friable paint and plaster and detailed a three-step treatment park staff members might safely apply. They were to remove most of the disfiguring dust, adobe drip, and bird droppings by careful brushing, fix the surface with a light spraying of the synthetic resin, then point the broken plaster edges.[16]

Steen's initiative apparently led the Service to seek more information about the work going on at the Fogg. While negotiations were in progress for the Tumacacori consultation, Superintendent Edwin W. Small of Salem Maritime visited the museum and met Gettens. "He is very much interested in the subject of establishing professional standards for people engaged in the conservation of the objects of art and archaeology . . . ," Small wrote Chief Historian Ronald Lee. "I look forward to having him visit Salem and the Adams Mansion and appraise our needs . . . ."[17]

Burns must have wasted little time at that point in beginning the steps necessary to establish a position in the Museum Branch for a Fogg-trained conservator. Harold Peterson, who became a staff curator in the branch in 1947 and who had a particular interest in the preservation of historic weapons and related objects, surely supported this course. Peterson learned all he could by observation, reading, discussion, and experiment, then applied treatments with care while critically appraising the results. He personally cleaned and gave preservative treatment to some specimens for park exhibits under construction, but his informed interest in such matters became more obvious in 1949 during the first Museum Methods Course (Chapter Four). Under his watchful eye trainees and also fellow instructors learned to remove corrosion from gun barrels without scratching the underlying surface. He taught them to pick rust from pits with pointed

wood sticks and never to use such shortcuts as buffing wheels and power brushes.

Peterson's concern for proper conservation of park museum specimens reinforced Burns' sense of how critical the problem had become. A request soon went out from Washington headquarters for specific information on cultural objects in urgent need of preservative action. A response filled with photographs of deteriorating specimens in the eastern parks in August 1949 provided the Museum Branch with good support for a renewed appeal to fund object conservation, and the 1951 fiscal year appropriation included money for the purpose. Meanwhile, Colonial National Historical Park reactivated its archeological laboratory and resumed the electrochemical reduction and paraffin coating of excavated iron during the summer of 1949. To help support the laboratory the regional office urged parks to send specimens of this type to Jamestown for treatment at a cost of fifty cents to two dollars per object.[18]

The Museum Branch demonstrated its growing awareness of higher conservation standards when it installed the exhibits for the new William H. Jackson wing of the Scotts Bluff National Monument museum in the late summer of 1949. Most commercially available matboard had a cheap paper core sealed front and back by thin layers of high-grade paper. Acid content of the core paper could reach and damage the art mounted in the mat through the cut edges of the mat window. Only a few manufacturers supplied matboard composed throughout of 100% rag stock virtually acid-free. The branch specified the use of all-rag mats when it ordered Jackson's sketches matted and framed for the exhibits. When the framed pictures arrived at the park on the verge of the museum opening, however, they had ordinary mats. The branch rush-ordered matboard of the specified quality, and Robert Scherer, a highly competent preparator, rematted the sketches after the opening ceremony.

In the fall of 1950 Burns tried to recruit John Gettens for his conservation position. Gettens accepted another offer from the Freer Gallery of Art but recommended two of his Fogg Museum colleagues. Burns selected Elizabeth H. Jones, who entered on duty the following May after the branch converted the largest, lightest office in its dingy, parking-garage laboratory to a paintings conservation studio for her use. She initiated the practice of surveying and recording the condition of paintings in park collections to select the pictures in most critical need. She brought to the Park Service the technique of "facing" deteriorating oil paintings before moving them to the laboratory and specified the design for packing boxes to transport paintings safely. In the studio she patiently applied the delicate processes of cleaning, relining, and restoring as needed with consummate skill.

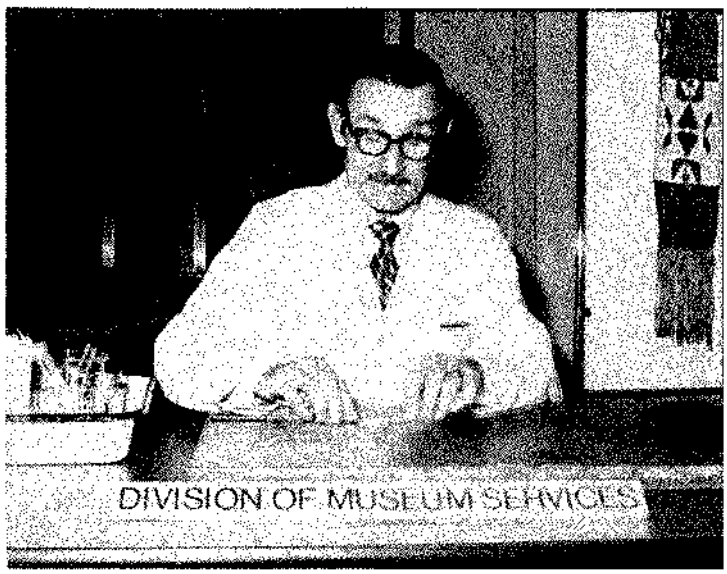
Performing such painstaking work with grace and proficiency, Betty Jones introduced the branch staff to new standards in the practice of object

Elizabeth H. Jones. The Park Service's first professionally trained conservator.
(Courtesy of the Straus Center for Conservation, formerly Center for Conservation and Technical Studies, Harvard University Art Museums, © 1993 President and Fellows of Harvard College.)

conservation. Although she had moved from an art museum environment of fine paintings chosen for aesthetic merit to one in which historical values predominated, she showed equal respect for the integrity of the original works and the same degree of care in examining and treating them. Most of her time went toward the examination and treatment of paintings from Independence National Historical Park and Adams National Historic Site for which the Service felt particularly urgent concern. She had made impressive progress when she returned to the Fogg Museum as its chief conservator in June 1952.[19]

Upon Jones' recommendation, the Museum Branch appointed Walter J. Nitkiewicz as her replacement. He had not trained at the Fogg Museum but had completed under Alfred Jakstas a thorough apprenticeship in art conservation as practiced there.[20] Continuing the knowledgeable examination and treatment program Jones had begun, he remained the staff paintings conservator for the branch and its successors until his death in 1979. The focus of his duties was easel paintings, of which there were more than enough in park collections to keep a single conservator continuously busy.

The necessity to provide conservation of comparable standard for other kinds of cultural objects became apparent even before Jones' appointment, although no pool of formally trained conservators for such artifacts yet existed. Harold Peterson knew that the electrochemical treatment being



Walter J. Nitkiewicz. Park Service fine arts conservator.

used at Jamestown failed to a degree for iron artifacts exposed to salt water, and he had heard of Service archeologists losing some key objects of wet wood or leather that required specialized treatment immediately upon excavation. Upon his urging, the Museum Branch secured the hiring of Harry Wandrus as a full-time conservator assigned to the Jamestown archeological laboratory in April 1951.

Peterson had become acquainted with Wandrus while a graduate student at the University of Wisconsin. The young man had some grounding in chemistry. He was a discriminating arms collector practicing safe, effective ways to clean, restore, and preserve the objects he collected. He could handle machinery. At Jamestown he increased the laboratory's productivity while widening the range of specimens treated. His experiments with an Army field method for rust removal from weapons and equipment using acid demonstrated possibilities for its safe application in the laboratory. He sent his report to Ned Burns along with a sample of the new vapor-phase rust inhibitors he thought might find use in park collections.[21]

The temporary laboratory structure at Jamestown had to come down to make way for the permanent facilities that would mark the 350th anniversary of the Virginia colony, and Wandrus was transferred to the Museum Branch in Washington by early 1954. Setting up shop at the branch's museum laboratory (then in Temporary Building S on the Mall), he became its staff conservator for objects outside Walter Nitkiewicz's area of specialization. Here he faced a considerably wider variety of specimens in need of expert conservation, requiring him to expand his knowledge and skills.

Harry Wandrus. Park Service objects conservator.

In March 1954, for example, the laboratory had four Civil War flags, each unique in various ways, to clean and restore for exhibition. Fragile and sensitive to photochemical deterioration, they called for delicate handling in a sequence of exacting procedures. For help with these the branch turned to the Textile Museum of the District of Columbia. This small, specialized institution had emphasized scientific concern in the care of its collections and practiced well-considered ways of cleaning, repairing, and mounting specimens. Textile Museum staff visited the laboratory to examine the flags and suggest suitable methods for their treatment, and Wandrus attended an intensive three-day course at the museum on scientific cleaning procedures. He then proceeded to wash, restore, and mount the flags with guidance from its staff. From this beginning he developed his knowledge of conservation techniques for historic flags until his advice and help became widely sought.[22] Other textiles on which he worked included the Washington tents for Colonial National Historical Park and a 17th-century ecclesiastical stole, which he had the Textile Museum staff clean and repair before he devised a secure mounting.

March 1954 also saw a 19th-century carriage, which had been donated to Hampton National Historic Site, moved bodily into the laboratory for Wandrus to restore. Because horse-drawn vehicles and their accouterments were historically associated with many parks and required specialized historical knowledge, the Museum Branch engaged Paul H. Downing to

advise on the recurring problems of identification, evaluation, conservation, and interpretation of such objects.[23] Downing, who was guiding similar work at Colonial Williamsburg, specified the desired results of the carriage's restoration, directed Wandrus to the authentic materials required, and explained techniques carriage makers had historically employed. He did not believe that modern spray applications of paint and varnish, for example, could accurately replicate the original appearance. Work on this specimen, extending over two and a half years, provided a valuable learning experience for the conservator and set a restoration standard for vehicles in Park Service custody.

Other materials also demanded the conservation skills Wandrus was maturing. When Pinky Harrington discovered at Fort Necessity National Battlefield the location and ground plan of George Washington's short-lived field fortification, some of the long-buried stockade post stubs required prompt conservation. Wandrus chose alum impregnation as the surest, most practical method then available. The laboratory lacked the necessary equipment but he quickly improvised heaters and containers for prolonged immersion of the wood in hot alum solution, with satisfactory results.

This treatment would not do for the massive timbers uncovered by archeologists at Fort McHenry in 1958. They had supported the flagpole during the bombardment and were the only tangible remains at the fort so closely associated with the star-spangled banner of the national anthem. Sharing the early interest in polyethylene glycol as a preservative for waterlogged wood, Wandrus began studied application of this hygroscopic wax to the timbers in November 1958 and watched the effect of repeated treatment as incipient cracks closed and the wood resisted shrinkage or warping.[24] Before epoxies came into use to consolidate seriously decayed wood, Wandrus also experimented with soluble nylon as a consolidant in restoring an unusual ammunition cart from Morristown, although he later abandoned its use because of its aging characteristics. The collection of river boats he treated at Grand Canyon National Park required still other techniques.

Metal conservation remained the center of Wandrus's professional concern. In 1954 he checked all the specimens in the Fuller arms collection (Chapter Seven) and treated those exhibiting active deterioration. He repeated the inspection and needed treatments on an approximately annual schedule for years thereafter. Also in 1954, he carefully de-rusted and applied protective coatings to a substantial collection of architectural ironwork at the Jefferson National Expansion Memorial and conserved a recently excavated 16th-century sword for the state of New Mexico. His 1956 assignments included preservative treatment of arms and armor for Colonial National Historical Park and San Juan National Historic Site. The next year enough excavated iron awaited cleaning to warrant reassembly of

the former Jamestown laboratory equipment in his Washington shop. Conservation of the iron balcony railing at Congress Hall in Independence National Historical Park required his attention in 1961.[25]

Wandrus trained coworkers to assist in conservation and continually worked to improve his own technical knowledge and skills. He personally bought and studied at home the technical publications most pertinent to the problems he faced at work. He conferred with other conservators when possible and attended professional conferences. Before his untimely death in November 1965 he had become widely known and respected in the growing community of professional conservators. His influence on the collections in national park museums continued through the labors of the successor he had nurtured and the substantial technical library he donated to the Park Service.

Walter Nitkiewicz's basic task of caring for the easel paintings in park collections suffered interruption in 1955 when the Old Courthouse rotunda at Jefferson National Expansion Memorial underwent restoration. Its upper walls, dome, and lantern carried extensive mural decorations requiring conservation. Four large historical scenes by Carl Wimar occupied lunettes around the base of the dome, and more than twenty allegorical and historical figures by Ettore Miragoli completed embellishment of the soaring space. Nitkiewicz recruited and instructed a team of local art students and artists. Under his close supervision they worked day after day on high scaffolds readhering loose paint or plaster, cleaning the grime from paint surfaces with tested solvents, in-painting where necessary, and finally applying a protective coating. The job took from April 1955 to July 1956 and cost about $45,000.[26]

Nitkiewicz's extended absence from his normal duties emphasized how understaffed the Museum Branch laboratory was for painting conservation. Anne F. Clapp, the other of the two Fogg Museum-trained conservators John Gettens had recommended six years earlier, was again available after serving as conservator for collections at the Jamaica Institute. The branch seized the opportunity to hire her in October 1956. Initially sharing laboratory facilities with Nitkiewicz, she applied her expertise in cleaning and rematting 18th-century prints for George Washington Birthplace National Monument and Colonial National Historical Park. In January 1957 her duty station shifted to a new satellite conservation laboratory at Independence where she could care for that park's extensive portrait collection and other important Service paintings in the Northeast.

Anne Clapp's equipment also permitted treatment of paper-based specimens, and she managed to include a significant amount of paper conservation in her output. A historic ceiling painting in the Senate Chamber of Congress Hall became another addition to her primary workload. Paint, plaster and ceiling supports had so deteriorated that

adequate conservation required temporary removal of the ceiling section bearing the painting. In the summer of 1959 Clapp prepared the painted surface for the rigors of moving, and Frank Phillips from the Museum Branch supervised the delicate operation of cutting out the section and maneuvering it by crane out of the building and into a workroom. There Clapp executed a thoroughly professional conservation treatment of the painting and its support. Two years later Phillips saw to the mural's return intact to its original place in the restored chamber ceiling.[27]

In 1960 Anne Clapp accepted a position as paper conservator for the Intermuseum Conservation Association, terminating the satellite laboratory in Philadelphia and leaving Walter Nitkiewicz as the Service's only fine arts conservator. Independence could fill the gap in part by sending portraits in critical need to Betty Jones at the Fogg Museum under contract. Nitkiewicz, meanwhile, had continued to shoulder special assignments. At Castillo de San Marcos National Monument in 1958 he addressed difficult problems of preserving historic graffiti on plaster walls, a severely weathered coat of arms carved in stone over a fort entrance, and carved stone fonts in the fort chapel. That summer he cleaned and restored two large landscape paintings of Yellowstone and the Grand Canyon by Thomas Moran set in the paneled walls of the secretary of the interior's conference room.

Beginning in the fall of 1959 Nitkiewicz tackled a project of extreme technical complexity that would take two-and-a-half years to complete: restoring for permanent exhibition the Gettysburg cyclorama, about 27 feet high and 353 feet in circumference. The Service was erecting a carefully sited structure designed by Richard Neutra in which to display the colossal painting properly. Because special equipment would be needed to move large sizes and weights of canvas with precision and safety in confined spaces, Nitkiewicz enlisted Henri G. Courtais as a consultant conservation engineer. He also organized a team of four assistants drawn largely from the crew he had trained for work on the courthouse murals in St. Louis.

Nitkiewicz and his crew began by facing the entire painting with squares of Japanese tissue paper to hold in place any paint that might come loose. The usual facing technique required adaptation to counteract tensions in the weakened canvas. Using a transit, they established a level line around the complete circle of painted scene that would prove vital during reinstallation. Next they cut the painting into vertical strips narrow enough to fit on the twenty-foot-wide relining table. Lowering each strip in turn face down onto the padded table, they flattened the stiff, friable canvas by painstaking application of controlled heat and moisture working from the center outward. Infusion of a gelatin size enabled them to limit penetration of the relining adhesive. Patching breaks, replacing old repairs, and removing former reinforcements followed. Stretching the linen relining